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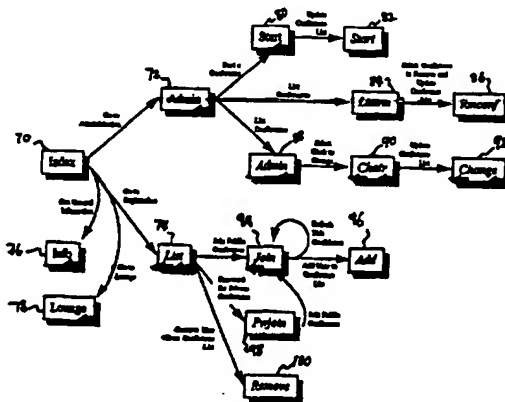
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(54) Title: **METHOD FOR CREATING PEER-TO-PEER CONNECTIONS OVER AN INTERCONNECTED NETWORK TO FACILITATE CONFERENCING AMONG USERS**



(57) Abstract

A method for facilitating the creation and participation of on-line conferences in accordance to the peer-to-peer paradigm is disclosed. A designated location on the network (e.g., a web site 56) such as Internet is set up so that a conference (94) may be created and conference participants (98) can be easily connected into the conference. The IP addresses of the conference participants (98) are maintained at the designated site and are transmitted to a new conference participant (98) to allow the new conference participant to connect directly into the conference without the new participant (98) having to know the IP addresses of the conference participants (98). The new participant may be connected to any one of the existing conference participants. Once the conference is established, no data goes through the designated site or a central host (56).

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Specification

**METHOD FOR CREATING PEER-TO-PEER CONNECTIONS OVER AN
INTERCONNECTED NETWORK TO FACILITATE CONFERENCING AMONG USERS**

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention generally relates to methods for establishing network connections for conferencing over computer networks, and more particularly, a method for establishing conferences and linking conference participants to the conferences over the Internet.

Description of the Prior Art

In hosting a conference over a computer network such as the Internet, the conference host advertises and promotes the conference as to the subject matter of the conference and the time and location of the conference. Parties interested in participating in the conference join the conference via their network connections at the designated time.

The traditional paradigm of an on-line conference, referring to Fig. 1, consists of a host server 10 connecting a number of conference participants or clients 12a - 12c through their respective individual channels 14a - 14c. This is a client/server paradigm where a host server connects a number of clients. Under this paradigm, a great deal of computing resources are consumed by the host server.

The traditional paradigm is no longer adequate in meeting the dynamic and flexible environment demanded by the activity of the network users of today and of the future. Ideally, given the level of activity on the Internet, a different paradigm, referring to Fig. 2, is desirable. In this peer-to-peer paradigm, there is no host server, and a number of clients 18a - 18e are connected via a number of channels 20a - 20e in a variety of manners. The advantage with this paradigm is that there is not a central host server to connect the clients. As long as the clients utilize application programs allowing communication across networks between the clients, this network paradigm is feasible and desirable.

However, there are several problems in establishing network connections over an interconnected network in accordance with the peer-to-peer paradigm. These problems prove to be cumbersome and sometimes are administratively impossible for the clients (or conference participants) to overcome. The problem lies in finding the Internet protocol ("IP") address of the client hosting the conference (conference chairperson) or the IP address of any one of the clients in the conference (conference participants).

An IP address uniquely identifies a user's Internet presence and is composed of four bytes of information representing a domain name and an identification number in that domain. By knowing the IP address of a user, an Internet connection can be established with that user.

However, the IP address of a particular user is not always the same. If a user dials into an Internet service provider ("ISP") in establishing an Internet connection, the users may be assigned a different IP address every time due to the fact that the ISP has a limited number of connections to the Internet and IP addresses must be dynamically allocated as requested. For users having direct connections

1 to the Internet through their company or organization, their IP addresses may be remapped, may change
2 over time, or may be machine dependent. Furthermore, many companies and organizations have a
3 computer network security barrier commonly referred to as a "firewall" to stop unauthorized intrusion into
4 their computer networks, and the firewall may translate an IP address for a particular computer or user
5 such that the computer or user is identified by a different address every time.

6 The problems with IP addresses minimize conferences from being established in accordance with
7 the peer-to-peer paradigm on the Internet, minimizing activities such as document conferencing, video
8 conferencing, etc.

9 10 SUMMARY OF THE INVENTION

11 It is therefore an object of the present invention to provide a method for dynamically establishing
12 a conference over the Internet in accordance with the peer-to-peer paradigm.

13 It is another object of the present invention to provide a method for maintaining the IP addresses
14 of the conference participants of a conference for the purpose of allowing a new user to join a conference
15 without having to know the IP addresses of the conference participants.

16 Briefly, a method for facilitating the creation and maintenance of network connections over an
17 interconnected network for the purpose of facilitating the creation and participation of on-line conferences
18 in accordance to the peer-to-peer paradigm is disclosed. A designated location on the network (e.g. a web
19 site) on an interconnected network such as the Internet is setup in such a manner that a conference may be
20 created and conference participants can be easily connected into the created conference by making a few
21 simple selections. The IP addresses of the conference participants are maintained at the designated site
22 and are transmitted to a new conference participant to allow the new conference participant to connect
23 directly into the conference without the new participant having to know the IP addresses of the conference
24 participants. The new participant may be connected to any one of the existing conference participants.
25 Once the conference is established, no data goes through the designated site or a central host. Data packets
26 are directly sent to and received by the respective application program of each participant.

27 An advantage of the present invention is that a conference participant may join a conference
28 without having to know the IP addresses of other conference participants.

29 Another advantage of the present invention is that the established conference has no data going
30 through a central host or a designated site.

31 These and other objects and advantage of the present invention will no doubt become obvious to
32 those of ordinary skill in the art after having read the following detailed description of the preferred
33 embodiments.

34 35 IN THE DRAWINGS

36 Fig. 1 illustrates connections in accordance to the client/server paradigm where users are
37 connected to a central server for the purpose of conferencing.

38 Fig. 2 illustrates connections in accordance to the peer-to-peer paradigm where users are
39 connected to each other without a central host.

1 Figs. 3-7 show web page layouts and hypertext selections in the preferred embodiment of the
2 present invention.

3 Fig. 8 shows the basic architecture for web interface.

4 Fig. 9a is an overall design of the menu and command structure of the preferred embodiment.

5 Fig. 9b is a table of keys to Fig. 9a.
6

7 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

8 The preferred embodiment of the present invention provides a virtual conference hall on the
9 World-Wide Web ("WWW") as a clearinghouse for all the conferences. A user, by using a web-browser
10 and a helper-application program, may go to the virtual conference hall, announce and advertise a
11 conference, create a conference, or join an on-going conference.

12 The host machine supporting the virtual conference hall does not actually host any conferences
13 by receiving and redistributing data packets. Rather, the virtual conference hall facilitates the
14 establishment of conference connections for users wishing to participate in a conference. Once a
15 conference is established, data transmission from one user to another user is routed directly via the
16 appropriate Internet protocol and transmission paths. For example, a user, by indicating the conference of
17 his or her choice, is connected to the conference whereby an Internet connection is automatically
18 established between this user and one of the existing conference participants without the user having to
19 know the IP address of a conference participant.

20 Illustrating an example of the process of using an implementation of the present invention, a user
21 by using a web browser goes to a designated site on the Internet such as "http://www.conferencehall.com."
22 At this site, referring to Fig. 3, several selections are available to the user, administration 31, registration
23 33, general information 35, and lounge 37. Referring to Fig. 4, the administration selection provides the
24 user with the option to create a conference 38, remove a conference 42, or have the user be the designated
25 chairperson of a particular conference 40. If the user chooses to create a conference, referring to Fig. 5,
26 the user is then provided with a form asking for information pertinent to the conference, information such
27 as the conference title, host of the conference, subject of the conference, the user's name, the conference
28 type, and an administrative password. When a conference is created, a conference record for this
29 particular conference is created and inserted into a conference list containing the records for all the
30 conferences. This list is automatically updated to reflect the conference as an on-going conference where
31 people may freely participate in it if it is a public conference. Referring back to Fig. 4, under the
32 administration page, a user may select to remove a conference (42) after the conference is over, provided
33 that the user has the administrative password for the conference. An automatic conference removal
34 method can also be implemented, as opposed to the manual removal process. As a third selection under
35 the administration page, the user may select to change the chairperson of a conference (40), and the
36 conference list will be updated to reflect such a change.

37 A user interested in becoming a conference participant, referring to Fig. 6, may register for a
38 conference by selecting an ongoing conference from a list of on-going conferences. Referring to Fig. 7, if
39 a conference is a public conference, the user joins the conference, and the user's name, IP address, and

1 other pertinent information is added to the conference record. Information regarding this conference is
2 refreshed accordingly 58. In joining a conference, a helper application (or plug-in software) predefined in
3 the pertinent section of the web browser is automatically launched and the user is connected to the selected
4 conference through the helper application where the IP address of the conference chair or the conference
5 participant(s) is automatically provided to the helper application to establish the Internet connection.
6 Through the helper-application, the user becomes a conference participant and can begin discussions with
7 other conference participants.

8 If the selected conference is a private conference, a password is requested before the user is
9 allowed to join a conference. After finishing with a conference, a conference participant may remove his
10 or her name from the conference list. The process for removing a conference participant from a
11 conference list may be automated by periodically polling the status of the IP connection with the net
12 browser or helper-application of the respective conference participants.

13 Having now described the process via one implementation of the present invention, the
14 underlying techniques are now described. Fig. 8 illustrates the basic architecture for the World Wide Web
15 interface for the preferred embodiment. The user 52 activates a web browser (also called net browser) 54
16 and connects to the Internet via the web browser. By visiting a site (web server 56) such as the virtual
17 conference hall in our example "http://www.conferencehall.com", a file in the hypertext mark-up language
18 (HTML) format is sent to the user and displayed by the web browser on the user's computer (remote
19 computer). In certain cases, a form requesting information from the user is sent to the user in HTML
20 format. By completing the form and sending it back to the web server (the host computer), a designated
21 common gateway interface (CGI) script 58 (which is a series of commands in the PERL programming
22 language) may be programmed to be executed by the web server. The commands in the script file may
23 request the web server 56 to send a formatted Multi-Purpose Mail Extension (MIME) type stream to the
24 user's web browser which may activate a particular helper application 60 to connect the user's helper-
25 application to other conference participant's helper-applications 62.

26 Fig. 9a illustrates an overall menu and command structure (corresponding to Figs. 3-7) of an
27 implementation of the preferred embodiment of the present invention and Fig. 9b provides a table of keys
28 to the box symbols used in Fig. 9a. The menu and command structure are briefly described and the major
29 functions such as the create-a-conference function and the join-a-conference function are described in
30 detail in the following sections. When visiting the virtual conference hall on the Internet, the web server
31 sends to the user the index.html file 70 which provides several hypertext selections. By clicking on a
32 selection, the corresponding CGI script file may be executed and the corresponding HTML file is sent to
33 the user 72-78.

34 From the administration HTML page 72, the user may select the start-a-conference selection 80
35 whereby the corresponding CGI script file is executed, a new conference record is created, and the
36 conference list is updated. The user also may select to remove a conference. In this operation, the list of
37 on-going conferences are displayed (84) to the user, the user selects a conference to remove, and, given the
38 right password, the underlying remove-conference CGI script is executed (56) to remove the
39 corresponding conference record. As a third selection under the administration page, the user may change

1 the chairperson of a conference by displaying the list of on-going conferences (88), and select and change
2 the conference chair (90) of a particular conference. The corresponding CGI script updates the conference
3 list.

4 Under the registration page 74, a user may join a public conference 94 whereby the user is asked
5 to fill out a form and the user is added to the conference list 96. For a private conference, a password is
6 requested from the user (98) before the user is allowed to join the conference (94). After finishing with a
7 conference, the user may remove his or her name from the conference record 100.

8 The information page 76 may provide a variety of information regarding the conferences or any
9 other type of information. The lounge page 78 may provide links to other sites for browsing while a user
10 waits for other users.

11

12 Creating a Conference

13 In selecting the link to create a conference, a form is sent by the host server of the virtual
14 conference hall to the user's web browser. The form provides blank spaces requesting conference
15 information from the user, information such as the conference title, company name, subject of the
16 conference, the user's name, an administrative password, and a password if it is a private conference.
17 Once the form is filled out, the user clicks on a button on the screen which causes the form to be sent back
18 to the host server. In receiving the form, the host server activates a conference creation CGI script that
19 parses and extracts information from the form, and stores the extracted information as a new conference
20 record into a conference list or database containing records of all the on-going conferences. Furthermore,
21 the user's IP address is obtained from the CGI environment variable REMOTE_ADDR and stored in the
22 conference record. Then, a MIME type stream containing information regarding the helper application
23 that is to be launched by the user's browser and other pertinent information is sent back to the user's
24 browser. The user's browser upon receiving the MIME stream launches the designated helper application,
25 and the helper application is instructed to go into the listening mode to wait for incoming connection
26 requests. The helper application in this case can be any conferencing software. In the preferred
27 embodiment, the document conferencing software TalkShow is used. With the helper application in
28 listening mode, one or more subsequent connections will establish a conference where users are connected
29 and may chat or pull up documents or graphs for discussion and annotation via their helper applications.

30

31 Joining a Conference

32 For a user to participate in a conference, the user clicks on the Conference Registration icon
33 which will cause the conference list to be displayed to the user. By clicking on the conference of his or
34 her choice, a form is sent to user requesting the user's name and a password if it is a private conference.
35 When the user sends the form back to the host server, a join-conference CGI script is executed where the
36 information provided by the user is extracted and stored in the corresponding conference record in the
37 conference list. This user's IP address is stored as well for later use. Then, a MIME stream containing the
38 IP address of the conference chair along with other pertinent information is sent back to the user. Upon
39 receiving this MIME stream, the user's web browser activates the same or a compatible helper-application,

1 and the IP address of the conference chair is provided to the helper-application. The helper-application
2 makes a TCP/IP call to the conference chair using the given IP address. Upon receiving the call, the
3 chairperson's helper-application connects to the caller and a conference session is thereby established.

4 Once the conference session is established, there is no traffic (data packets) going through the
5 conference hall server machine (the host computer). The conference participants communicate directly to
6 each other via their helper-applications.

7 In the case where the connection for the conference chair is dropped and its IP address is no
8 longer active, another conference participant may become the conference chair by going back to the virtual
9 conference hall and updating the conference list via the "change chairperson" selection. This conference
10 participant then becomes the chairperson and its IP address is stored accordingly.

11 In an alternate embodiment, if the conference chairperson's connection is dropped and a new
12 conference chair is not designated, a new conference participant may join the conference by using the IP
13 address of any one of the current conference participants. This embodiment can be implemented by
14 sending the IP addresses of all the current conference participants in the MIME stream to the user's
15 browser and have the helper application be directed to try all the addresses until an active address is found.

16

17 Removing a Conference Participant

18 A conference participant may leave the conference and manually sign off the conference via a
19 provided selection on the registration page of the virtual conference hall so that the user's name will not be
20 shown as a conference participant. The user's name will be deleted from the conference record by a CGI
21 script. This process can also be automated where the server of the virtual conference hall periodically
22 samples the connections to determine existing conference participants and updates the conference record
23 accordingly.

24 Note that in the case where a network has a firewall and there is a SOCKS proxy running between
25 the browser and the web server, the CGI script gets the IP address of the SOCKS proxy rather than the IP
26 address of the client machine that is running the browser. This problem is solved by providing a name
27 registration daemon that registers each participant's IP address and port number. When the helper-
28 application is launched by the browser, the helper-application first makes a TCP/IP connection to the
29 daemon so that the daemon registers the helper-applicant's client's IP address.

30 Although the present invention has been described in terms of the presently preferred
31 embodiment, it is to be understood that such disclosure is not to be interpreted as limiting. Various
32 alterations and modifications will no doubt become apparent to those skilled in the art after reading the
33 above disclosure. Accordingly, it is intended that the appended claims be interpreted as covering all
34 alterations and modifications as fall within the true spirit and scope of the invention.

35 What I claim is:

36

CLAIMS

- 1 1. A method for establishing peer-to-peer network connections over an interconnected
2 network for two or more users, comprising the steps of:
3 a) receiving by a host computer connection information of a first user using a first
4 remote computer having a first network address, said connection information including said first network
5 address of said first remote computer;
6 b) storing on said host computer said connection information of said first user;
7 c) receiving by said host computer connection information of a second user using a
8 second remote computer having a second network address, said connection information of said second
9 user including said second network address of said second remote computer;
10 d) storing on said host computer said connection information of said second user; and
11 e) sending by said host computer said connection information of said first user to said
12 second remote computer, said second remote computer using said connection information of said first user
13 establishing a direct network connection to said first remote computer.
- 1 2. A method of claim 1 further including the steps of:
2 f) receiving by said host computer connection information of a third user using a third
3 remote computer having a third network address, said connection information of said third user including
4 said second network address of said third remote computer;
5 g) storing on said host computer said connection information of said third user; and
6 h) passing said connection information of said first user to said third remote computer,
7 said third remote computer using said connection information of said first user establishing a direct
8 network connection to said first remote computer.
- 1 3. A method of claim 1 further including the steps of:
2 f) receiving by said host computer connection information of a third user using a third
3 remote computer having a third network address, said connection information of said third user including
4 said second network address of said third remote computer;
5 g) storing on said host computer said connection information of said third user; and
6 h) remote computer using said connection information of said second user establishing a
7 direct network connection to said second remote computer.
- 1 4. A method as recited in claim 1 wherein said connection information of said first user
2 further includes a conference title and a host name.
- 1 5. A method as recited in claim 1 wherein said direct network connection for a particular
2 user is terminated by the steps of:
3 sending by the remote computer of said particular user a request for termination of said
4 direct network connection of said particular user;

5 receiving by said host computer of said request; and
6 deleting said connection information of said particular user from said host computer.

1 6. A method for establishing peer-to-peer network conferencing connections over the
2 Internet for two or more users, comprising the steps of:

- 3 a) receiving by a host computer the connection information of a first user using a first
4 remote computer having a first Internet-protocol address for establishing a conference over the Internet,
5 the connection information including said Internet-protocol address of said first remote computer, and
6 conference information;
7 b) storing on said host computer the connection information of said first user;
8 c) receiving by said host computer the connection information of a second user using a
9 second remote computer having a second Internet-protocol address, the connection information of said
10 second user including said second Internet-protocol address of said second remote computer;
11 d) storing on said host computer the connection information of said second user; and
12 e) passing the connection information of said first user to said second remote computer,
13 said second remote computer using the connection information of said first user establishing a direct
14 network connection to said first remote computer.

1 7. A method of claim 6 further including the steps of:

- 2 f) receiving by said host computer connection information of a third user using a third
3 remote computer having a third network address, said connection information of said third user including
4 said second network address of said third remote computer;
5 g) storing on said host computer said connection information of said third user; and
6 h) passing said connection information of said first user to said third remote computer.
7 said third remote computer using said connection information of said first user establishing a direct
8 network connection to said first remote computer.

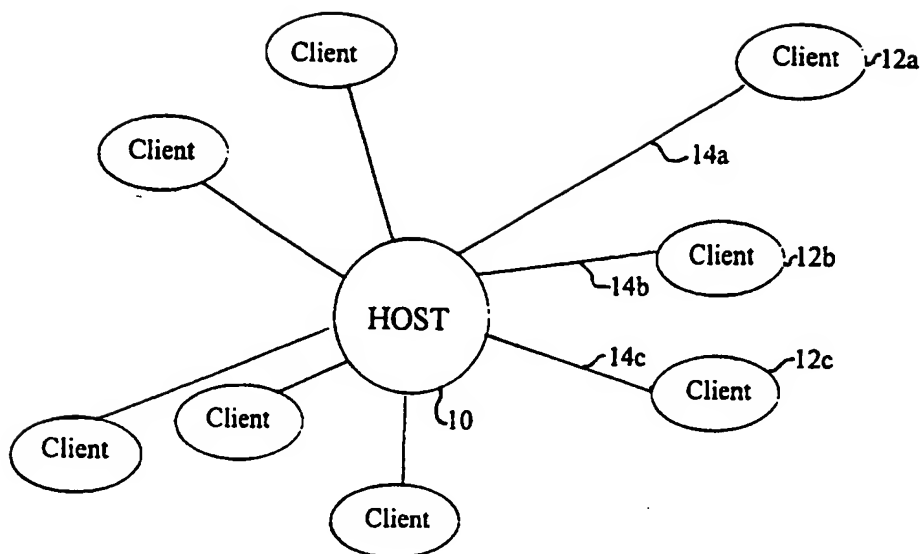
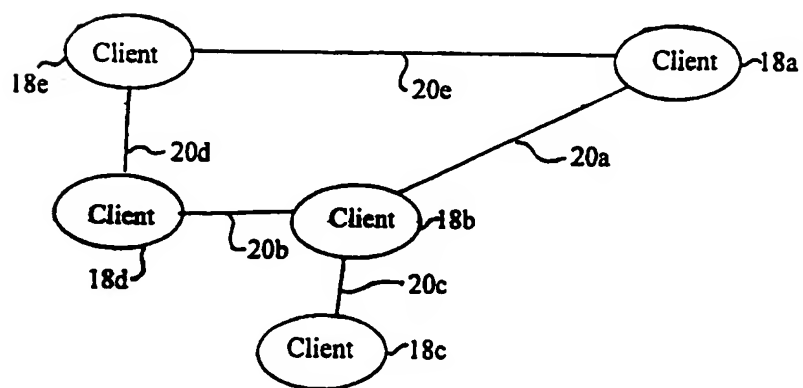
1 8. A method of claim 6 further including the steps of:

- 2 f) receiving by said host computer connection information of a third user using a third
3 remote computer having a third network address, said connection information of said third user including
4 said second network address of said third remote computer;
5 g) storing on said host computer said connection information of said third user; and
6 h) passing said connection information of said second user to said third remote
7 computer, said third remote computer using said connection information of said second user establishing a
8 direct network connection to said second remote computer.

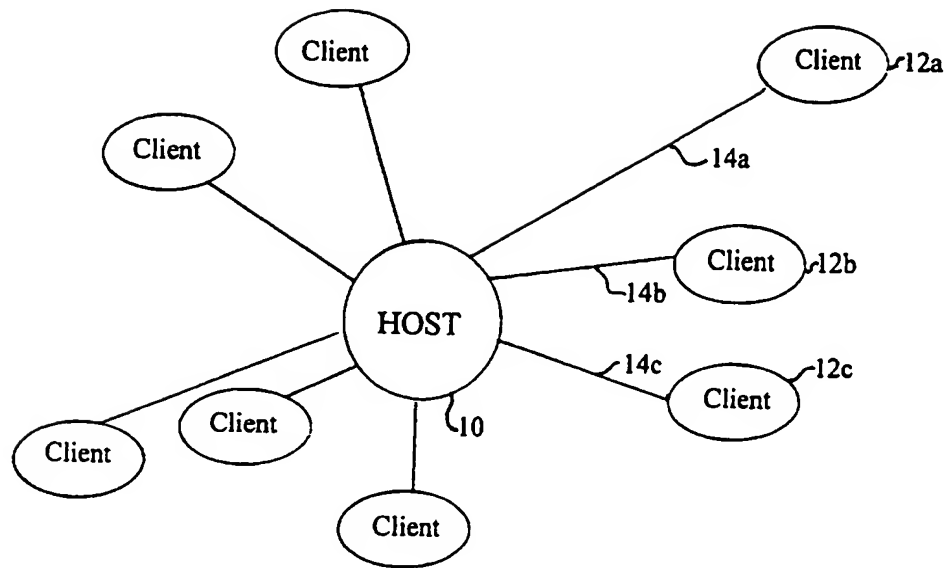
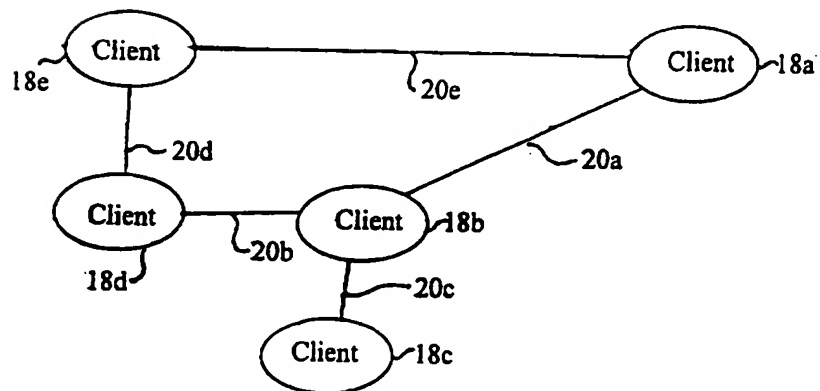
1 9. A method as recited in claim 6 wherein said conference information includes a
2 conference title and a host name.

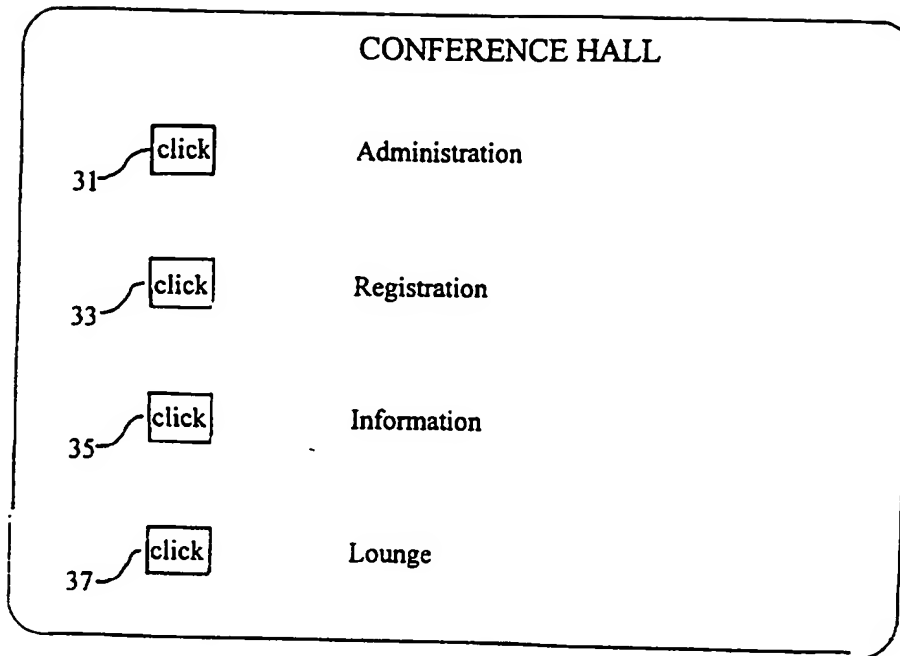
- 1 10. A method as recited in claim 6 wherein said direct network connection for a particular
2 user is terminated by the steps of:
3 sending by the remote computer of said particular user a request indicating termination
4 of the direct network connection of said particular user;
5 receiving by said host computer of said request; and
6 deleting the connection information of said particular user from said host computer.

1/7

Fig. 1Fig. 2

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Fig. 1Fig. 2

Fig. 3

CREATE A CONFERENCE

Conference Title: _____

Chairperson: _____

Subject: _____

Your Name: _____

Conference Type: ☐ Public ☐ Private

Administrative Password:

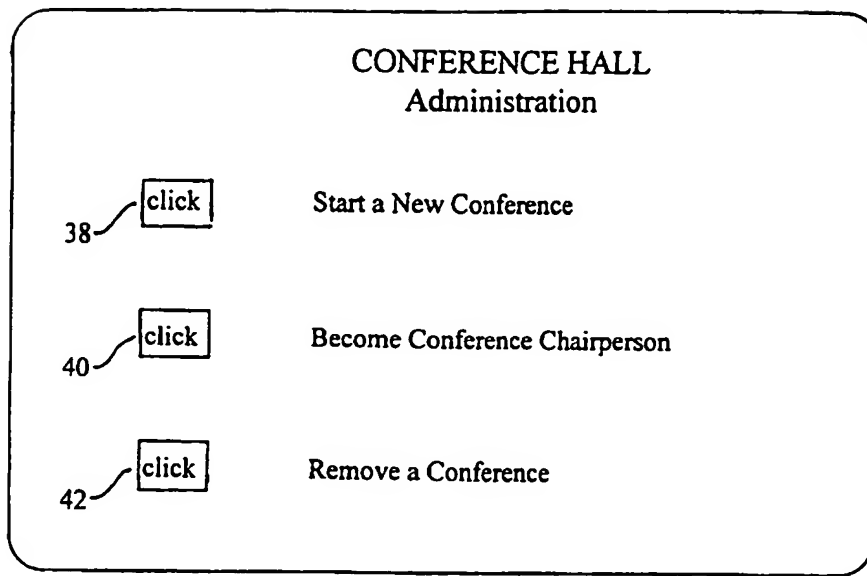
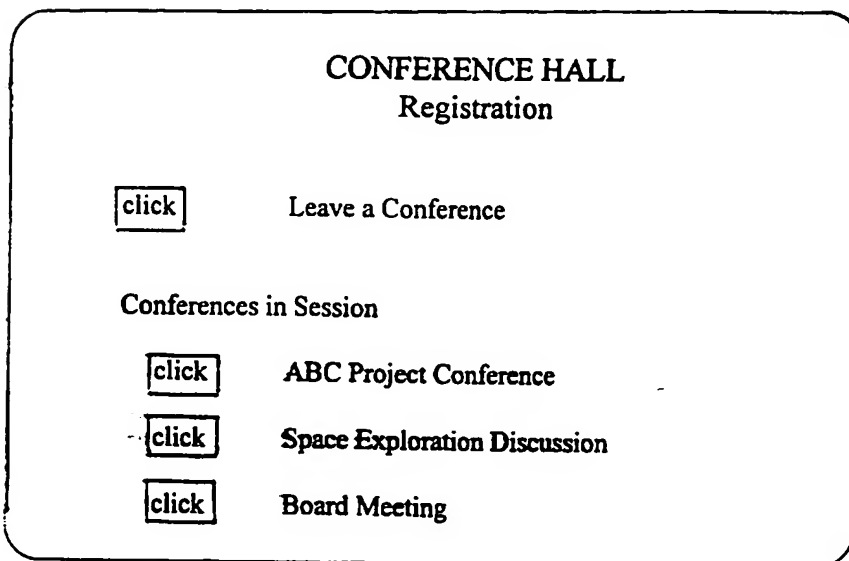
Verify:

Private Password:

Verify:

Create Conference

Fig. 5

Fig. 4Fig. 6

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CONFERENCE REGISTRATION	
Conference	: ABC Project Conference
Subject:	Project Progress Report
Chairperson:	John
Participants:	John, Mike, Susan
Your Name:	<input type="text"/>
Password: (for private conference)	<input type="text"/>
<input type="button" value="Click"/>	Join Conference

Fig. 7

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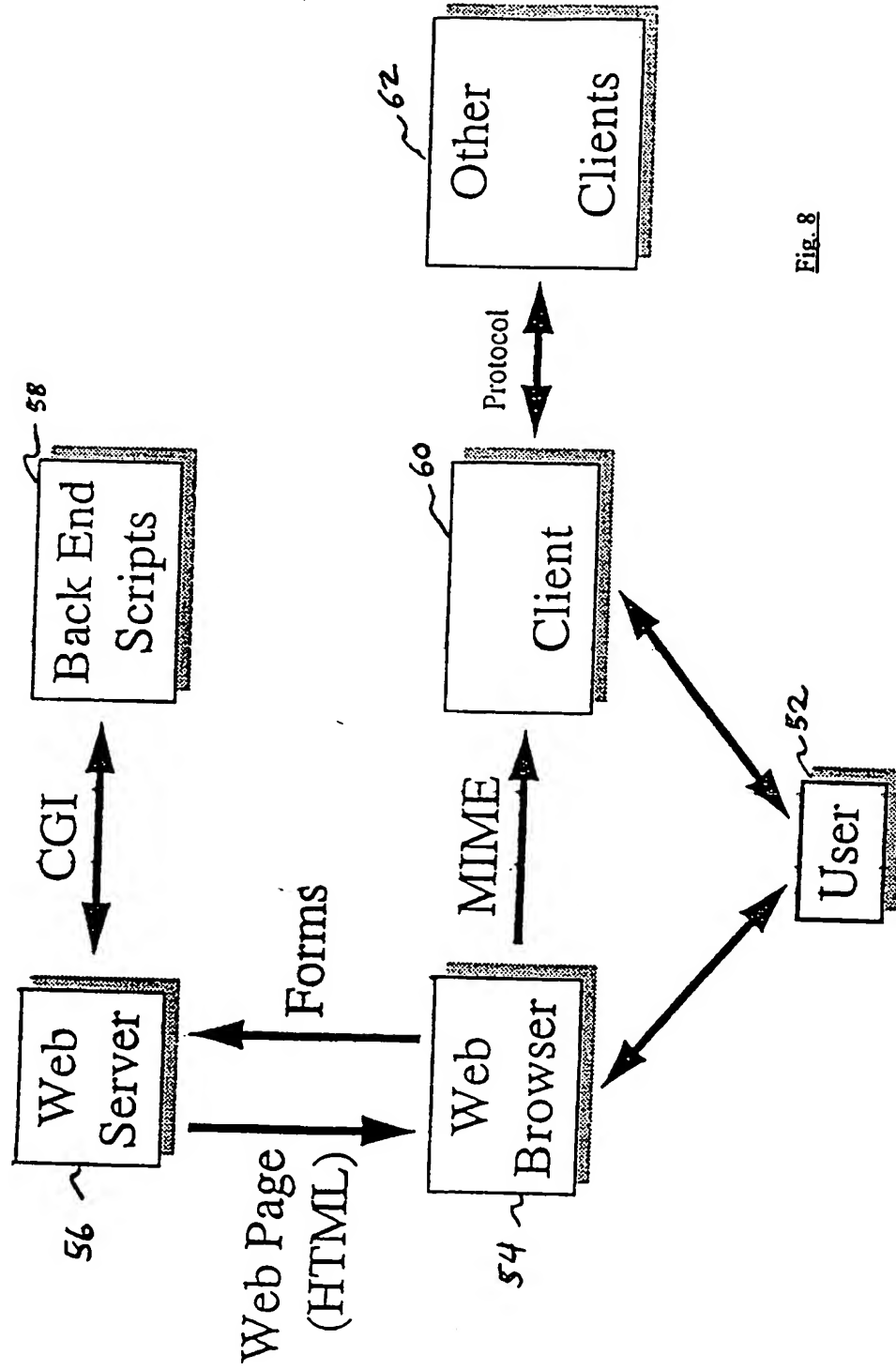


Fig. 8

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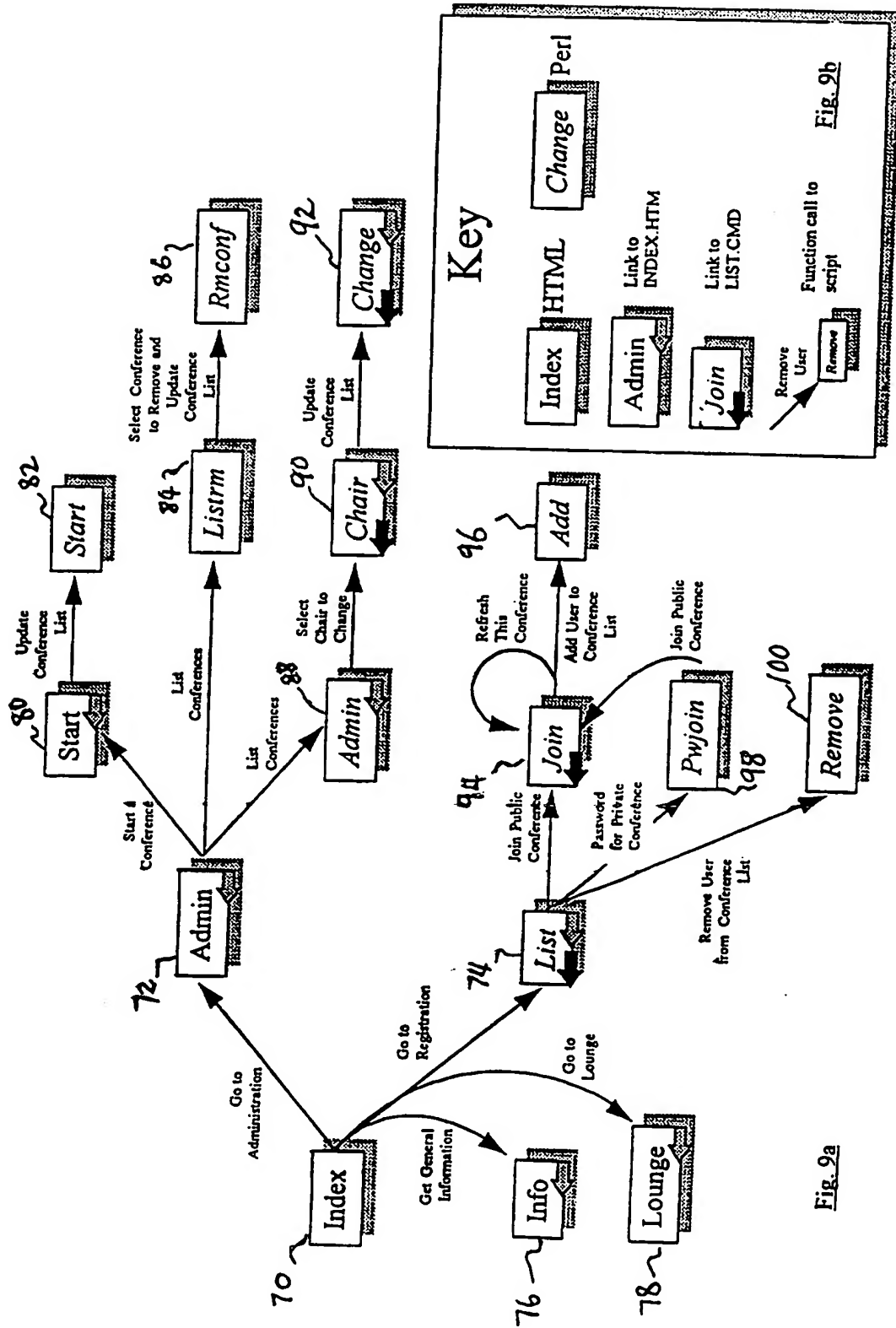


Fig. 9a

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/03099

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G06F 13/00

US CL : 395/200.09

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/200.09

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

IEEE Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, 5,475,819, A (MILLER ET AL.) 12 December 1995, col. 2, co.4, col. 6-7.	1-10
Y	Wise et al., IEEE publication, 1993, "Message-Brokers: A Novel Interprocess Communications Primitive, pages 184-193, especially 186.	1-10
A,P	US, 5,572,643, A (JUDSON) 05 November 1996, the whole reference.	1-10
A,P	US, 5,546,584, A (LUNDIN ET AL.) 13 August 1996, the whole reference.	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	* T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
* A		document defining the general state of the art which is not considered to be part of particular relevance
* E		earlier documents published on or after the international filing date
* L		document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reasons (as specified)
* O		document referring to an oral disclosure, use, exhibition or other means
* P		document published prior to the international filing date but later than the priority date claimed
	* X	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
	* Y	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
	* A	document member of the same patent family

Date of the actual completion of the international search

03 APRIL 1997

Date of mailing of the international search report

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